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EXAMINER	
BREIER, KRYSTINE E	

ART UNIT	PAPER NUMBER
3663	

NOTIFICATION DATE	DELIVERY MODE
12/07/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/598,732	WELKER ET AL.	
	Examiner	Art Unit	
	KRYSTINE BREIER	3663	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *07 August 2010*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-23,25-37,39-47,49,51 and 53-67* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) *1-23, 25-37, 39-47, 49, 51, 53-67* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 08/07/2010 has been entered.

Response to Arguments

2. Applicant's amendments filed 08/07/2010 have been entered.

3. Applicant's arguments with respect to claims 1-23, 25-28, 30-37, 39-47, 49, 51, and 53-67 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 101

4. 35 U.S.C. 101 reads as follows:

> Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

Claim 55 is rejected under 35 U.S.C. 101 because the disclosed invention is inoperative and therefore lacks utility. Claim 55 recites: "the measurements comprise current, wind or combinations thereof". However, current and wind are not numerical data which can be measured. For purposes of examination, the Examiner is reading this claim to recite "the measurements comprise current *velocity*, wind *velocity* or combinations thereof". Appropriate correction is required.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 1-3, 6, 9-15, 18, 19, 22, 25, 27, 28, 30, 39-46, 49, 51, 54, 55, 59, 63, 65, and 66 are rejected under 35 U.S.C. 103(a) as being unpatentable over Zajac (6691038) in view of Bennett (6590831).

7. With respect to claim 1, Zajac teaches collecting input data from a seismic survey spread having a plurality of spread control elements (Col 4, lines 52-54), a plurality of navigation nodes (Col 7, lines 22-25; Col 9, lines 4-12), and a plurality of seismic sources (Col 6, lines 40-42) and seismic streamers (Col 4, lines 51-52) containing receivers (hydrophones) (Col 1, lines 34-35), input data including: navigation data for the navigation nodes (Col 2, lines 5-59), operating states from sensors associated with the spread control elements (Col 5, lines 19-20; Col 8, lines 23-25; Col 7, lines 47-49; Col 9, lines 34-36), environmental data for the survey (Col 2, lines 61-62; Col 7, lines 42-46), and survey design data (Col 2, lines 62-64; Col 9, lines 10, 20), estimating positions of the receivers using the navigation data, the operating states, and the environmental data (Col 5, lines 5-7; Col 8, lines 29-31); determining optimum tracks for and receivers using the estimated positions and a portion of the input data that includes at least the survey design data (Col 5, line 7, Col 8, lines 7-9); and calculating drive commands for at least two of the spread control elements using the determined

optimum tracks (Col 5, lines 8-10), wherein at least one of the spread control elements comprise a streamer control element (Col 7, lines 1-12). However, it does not teach estimating the positions of the seismic sources, determining the optimal paths for the seismic sources, and calculating drive commands for a seismic source control element.

8. Bennett teaches estimating the positions of the seismic sources (Col 9, lines 30-32, 59-66), determining the optimal paths for the seismic sources (Col 9, lines 5-8; Col 10, lines 55-56), and calculating drive commands for a seismic source control element (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Zajac with the source control of Bennett since such a modification would have given improved accuracy in the determination of subsurface features and better midpoint coverage of the surveyed area.

9. With respect to claim 2, it is inherent that the master controller (Col 5, line 11) of Zajac contains instructions for performing the steps which it performs in the method of claim 1 using the navigation data (Col 8, lines 29-30), the operating states (Col 5, lines 19-22), the environmental data (Col 8, lines 31-32) and the survey design data (Col 8, lines 23-25, 33) as inputs. Thus the estimating, determining, and calculating steps are performed by this "transfer function".

10. With respect to claim 3, Zajac teaches the positions are estimated according to a spread model within the transform function, and the optimum tracks are input to the spread model for calculation of the drive commands (Col 9, lines 41-42).

11. With respect to 6, Zajac teaches the predicted residuals are use to estimate error states associated with measurements of the environmental data (Col 5, lines 19-20; Col 10, lines 56-64).

12. With respect to claim 9, Zajac teaches the drive commands include commands for controlling at least one vessel propeller, vessel thruster, spread component steering device (Col 8, lines 64-67), or vessel cable winch.

13. With respect to claim 10, Zajac teaches the sensors associated with the spread control elements include one or more sensor types of tension, water flow rate (Col 9, lines 34-36), inclination, orientation, acceleration or combinations thereof.

14. With respect to claim 11, Zajac teaches the collected environmental data includes one or more data types of current (Col 2, line 61), salinity (Col 2, lines 61-62), temperature (Col 2, line 61), pressure, speed of sound, wave height, wave frequency, wind speed (Col 2, line 61), and wind direction.

15. With respect to claim 12, Zajac teaches the survey design data is selected from spread tracks, performance specifications (Col 2, lines 62-64), and survey objectives, wherein the performance specifications are selected from drag and maneuvering characteristics for the vessel (Col 2, line 64), steerable cable devices (Col 8, lines 23-25), steerable seismic source devices, and deflectors, drag characteristics for the towed cables (Col 2, lines 62-64; Col 8, lines 23-25), seismic sources, and floatation devices, and winch operating characteristics.

16. With respect to claim 13, Zajac teaches the survey design data includes one or more data types of area, depth (Col 9, line 10), area rotation or shooting orientation, line

coordinates, required coverage, local constraints, optimizing factors and historical data (Col 9, line 20).

17. With respect to claim 54, Zajac teaches the collected input data includes one or more data types of pre-survey, operator input (Col 8, line 9), present survey, near-real time, real-time survey (Col 8, line 3), and simulated survey.

18. With respect to claim 14, Zajac teaches the operator input data includes spread parameter settings (Col 8, lines 7-9) and environmental data, and wherein the pre-survey data includes environmental sensor data (Col 2, 61-66).

19. With respect to claim 15, Zajac teaches the real-time survey data includes one or more data types of cable tension, water flow rate (Col 9, lines 34-36), inclination, orientation, acceleration, velocity, position (Col 9, lines 10-12), spread control element setting, environmental data, seismic signal and noise data, and operator input.

20. With respect to claims 18 and 22, Zajac teaches the spread model is a hydrodynamic force model of the spread components, a pure stochastic model of the spread components, employing one of the L-norm fitting criteria, or a neural network (Col 9, lines 41-42).

21. With respect to claim 19, Zajac teaches the force model contains marine current data (Col 9, lines 41-43).

22. With respect to claim 25, Zajac teaches towing a plurality of seismic survey spread elements generally behind a vessel having one or more spread control elements (Col 4, lines 51-54; Col 6, lines 34-57); providing a first set of desired coordinate positions of at least two of the spread control elements (Col 5, line 7; Col 8, lines 11-15),

wherein the set of desired coordinate positions is determined using navigation data for a plurality of navigation nodes, operating states from sensors, environmental data for a seismic survey, and survey design data (Col 8, line 57-Col 9, line 58) independently measuring the a set of actual coordinate positions of the at least two of the spread control elements (Col 4, lines 66-67; Col 8, lines 15-17), therein at least one of the control elements is a streamer control element (Col 7, lines 1-12); calculating a difference between the set of desired coordinate positions and the set of actual coordinate positions to form residuals (Col 5, lines 5-7; Col 8, lines 29-31); and using the residuals as set points in one or more controllers calculating to calculate drive commands for the at least two of the spread control elements (Col 5, line 8; Col 8, lines31-35). However, it does not teach one of the spread control elements is a source control element.

23. Bennett teaches (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Zajac with the source control of Bennett since such a modification would have given improved accuracy in the determination of subsurface features and better midpoint coverage of the surveyed area.

24. With respect to claim 27, Zajac teaches planning a path for the vessel within a constraint corridor that allows steering available in the spread control elements to achieve a target shape and track for the seismic survey spread elements (Col 8, lines 1-38).

25. With respect to claim 28, Zajac teaches estimating optimum tracks for tow points of the spread control elements that provide a cross-line component relative to an optimum track for the spread control elements (Col 8, lines 11-15).

26. With respect to claim 30, Zajac teaches each of the drive commands is used to control at least one of position Col 9, lines24-25), speed (Col 9, lines 24-28), and heading of the vessel.

27. With respect to claim 39, Zajac teaches a vessel control element and a streamer control element in coordination with each other (Col 8, lines 45-51). However, it does not teach a vessel control element, a source control element, and a streamer control element in coordination with each other.

28. Bennett teaches a vessel control element, a source control element and a streamer control element in coordination with each other (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the control element coordination of Bennett since such a modification would have provided additional flexibility and control over the array.

29. With respect to claim 40, Zajac teaches a vessel control element (Col 8, lines 48, 65). However it does not teach a vessel control element and a source control element in coordination with each other.

30. Bennett teaches a vessel control element and a source control element in coordination with each other (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the

control element coordination of Bennett since such a modification would have provided additional flexibility and control over the array.

31. With respect to claim 41, Zajac teaches the spread control elements comprise a vessel control element and a streamer control element in coordination with each other (Col 8, lines 65-66).

32. With respect to claim 42, Zajac teaches a streamer control element (Col 8, lines 65-66). However it does not teach a streamer control element and a source control element in coordination with each other.

33. Bennett teaches a streamer control element and a source control element in coordination with each other (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the control element coordination of Bennett since such a modification would have provided additional flexibility and control over the array.

34. With respect to claims 43 and 44, Zajac teaches a vessel control element (Col 8, lines 48, 65). However, it does not teach the spread control elements comprise at least two vessel control elements in coordination with each other; one of the at least two vessel control elements is associated with a first vessel and another of the at least two vessel control elements is associated with a second vessel

35. Bennett teaches the spread control elements comprise at least two control elements in coordination with each other (Col 4, lines 20-58; Fig 1); one of the at least two vessel control elements is associated with a first vessel and another of the at least

two vessel control elements is associated with a second vessel (Col 4, lines 20-58; Fig 1).

36. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the vessel control elements of Bennett since such a modification would have maximized the safety of the vessels, seismic assets, and crew while also minimizing deviations from desired spatial configuration of the assets.

37. With respect to claim 45, Zajac teaches providing a seismic survey spread having one or more vessels (Col 4, line 51) and one or more spread control elements (Col 4, lines 52-54), wherein the spread control elements comprise one or more vessel control elements (Col 4, lines 38-39), and one or more streamer control elements (Col 4, lines 52-54); and controlling the seismic survey spread (Col 8, lines 31-35). However, it does not teach one or more source control elements; and coordinating the positioning of the vessel control elements, the source control elements and the streamer control elements.

38. Bennett teaches one or more source control elements (Col 10, lines 64-65); coordinating the positioning of the vessel control elements, the source control elements and the streamer control elements (Col 4, lines 20-58; Fig 1; Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the vessel control elements of Bennett since such a modification would have maximized the safety of the vessels, seismic assets, and crew while also minimizing deviations from desired spatial configuration of the assets.

39. With respect to claim 46, Zajac teaches providing a set of desired coordinate positions of the spread control elements (Col 5, line 7; Col 8, lines 11-15), wherein the set of desired coordinate positions is obtained from one or more data types selected from operating states from sensors associated with the spread control elements, environmental data for the survey and survey design data (Col 8, lines 1-29), independently measuring a set of actual coordinate positions and the set of actual coordinate positions of the spread control elements (Col 4, lines 66-67, Col 8, lines 15-17); calculating the difference between the set of desired coordinate positions and the set of actual coordinate positions to form residuals (Col 5, lines 5-7; Col 8, lines 29-31); and using the residuals as set points in one or more controllers to calculate drive commands for the spread control elements (Col 5, line 8; Col 8, lines 1-38).

40. With respect to claim 49, providing a seismic survey spread having one or more vessels (Col 4, line 51) and one or more spread control elements (Col 4, lines 52-54), wherein the spread control elements comprise one or more vessel control elements (Col 4, lines 38-39), one or more streamer control elements (Col 4, lines 52-54). However, it does not teach one or more source control elements, and controlling the seismic survey spread by coordinating the positioning of the streamer control elements and the source control elements.

41. Bennett teaches one or more source control elements (Col 10, lines 64-65); coordinating the positioning of the source control elements and the streamer control elements (Col 4, lines 20-58; Fig 1; Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac

with the vessel control elements of Bennett since such a modification would have maximized the safety of the vessels, seismic assets, and crew while also minimizing deviations from desired spatial configuration of the assets.

42. With respect to claim 51, Zajac teaches providing a seismic survey spread (Col 4, lines 49-57) having a first vessel (Col 4, line 51) having a first vessel control element (Col 4, lines 38-39). However, it does not teach a second vessel and second vessel control element, and controlling the seismic survey by coordinating the first and second vessel control elements.

43. Bennett teaches a second vessel control element associated with a second vessel (Col 4, lines 20-58; Fig 1); coordinating the positioning of at least two positioning control elements (Col 4, lines 20-58; Fig 1). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the vessel control elements of Bennett since such a modification would have maximized the safety of the vessels, seismic assets, and crew while also minimizing deviations from desired spatial configuration of the assets.

44. With respect to claim 55, Zajac teaches the measurements comprise current velocity (Col 7, line 44; Col 9, lines 19-20), wind velocity (Col 7, line 42), or combinations thereof.

45. With respect to claim 59, Zajac teaches providing a seismic survey spread having one or more vessels (Col 2, line 34), one or more source arrays (Col 6, lines 40-42), and one or more spread control elements (Col 4, lines 52-54), wherein the spread control elements comprise one or more vessel control elements (Col 8, lines 48, 65) and

one or more streamer control elements (Col 7, lines 1-12); and coordinating the positioning of the vessel control element and the streamer control elements (Col 8, lines 45-51). However, it does not teach one of the spread control elements is a source control element; steering the source array in a crossline motion using the source control element; and coordinating the positioning of the vessel control elements, the source control elements, and the streamer control elements.

46. Bennett teaches one of the spread control elements is a source control element (Col 10, lines 60-65); steering an array in a crossline motion using the source control element (Col 2, lines 30-46); and coordinating the positioning of the vessel control elements, the source control elements, and the streamer control elements (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Zajac with the source control of Bennett since such a modification would have given improved accuracy in the determination of subsurface features and better midpoint coverage of the surveyed area. It would have been obvious to one of ordinary skill in the art that the well-known lateral positioning devices described in Bennett would be used in the source positioning also described by Bennett. It would have been obvious to one of ordinary skill in the art to use the lateral positioning devices described in Bennett since such a modification would have improved control and survey coverage. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify they method of Zajac with the control element coordination of Bennett since such a modification would have provided additional flexibility and control over the array along the optimal path.

47. It is inherent in the operation of a tow vessel that the vessel control elements be used to steer the inline motion of the arrays. The forward movement of the vessel inherently determines the inline movement and position of the arrays.

48. With respect to claim 63, Zajac teaches the seismic survey is controlled for reoccupying coordinates from a prior survey to achieve a 4D time-lapsed seismic survey (Col 2, lines 66-67).

49. With respect to claim 65, Zajac teaches sensors measure tension, water flow rate (Col 9, lines 34-36), vertical inclination, body orientation, acceleration or combinations thereof associated with the spread control elements.

50. With respect to claim 66, the spread control elements comprise a vessel control element (Col 8, lines 48, 65).

51. Claims 4, 5, 7, 16, and 53 are rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Bennett and further in view of Brunet (6618321).

52. Zajac discloses the invention as discussed above. However, it does not disclose the spread model calculates a first set of estimated positions using input that includes at least the operating states and the environmental data, the navigation data includes a second set of estimated positions, and the first and second set of estimated positions are combined with the transform function to produce the estimated seismic source and receiver positions and predicted residuals; the predicted residuals are used to estimate a set of parameters that characterize the spread model, and the spread model parameters are used to calibrate the spread model; the optimum tracks are determined according to a weighting function within the transform function, wherein the weighting

function receives as inputs the survey design data and the estimated positions; the simulated survey data includes one or more data types of simulated pre-survey, simulated operator input, simulated current survey, simulated near-real time survey, simulated real-time survey, and simulated environmental data; the positions are estimated according to a spread model used to predict residuals, and further comprising: using the predicted residuals to estimate one or more parameters of the spread model; and feeding the parameters back into the spread model.

53. Brunet teaches the spread model calculates a first set of estimated positions using input that includes at least the operating states and the environmental data (Col 4, lines 39-41), the navigation data includes a second set of estimated positions (Col 4, lines 26-28), and the first and second set of estimated positions are combined with the transform function to produce the estimated source and receiver positions and predicted residuals; the predicted residuals are used to estimate a set of parameters that characterize the spread model, and the spread model parameters are used to calibrate the spread model (Col 5, lines 17-21); the optimum tracks are determined according to a weighting function within the transform function, wherein the weighting function receives as inputs the survey design data and the estimated positions (Col 4, lines 45-55; Col 5, lines 11-13); the simulated survey data includes one or more data types of simulated pre-survey, simulated operator input, simulated current survey, simulated near-real time survey, simulated real-time survey, and simulated environmental data (Col 2, lines 49-52); the positions are estimated according to a spread model used to predict residuals, and further comprising: using the predicted residuals to estimate one

or more parameters of the spread model (Col 5, lines 17-21); and feeding the parameters back into the spread model (Col 4, lines 42-55).

54. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the predicted residuals of Brunet since such a modification would have led to more accurate positioning results. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the weighted optimum track determination of Brunet since such a modification would have ensured that the most important factors were those which were taken most strongly into account in the path determination. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the simulated data of Brunet since such a modification would have given a good prediction of environmental factors to take into account for more accurate positioning of the streamers.

55. Claim 8 is rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Bennett and further in view of Saban (5448233).

56. Zajac as modified teaches the invention as discussed above. However, it does not teach validating the calculated drive commands and delivering the validated drive commands to the spread control elements, whereby a desirable survey objective may be attained.

57. Saban teaches validating and subsequently executing drive commands (Col 4, lines 21-24). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the command validation of Saban,

since such a modification would have ensured collisions with obstacles or other components.

58. Claims 17 and 23 are rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Bennett and further in view of Riley (7446706).

59. With respect to claim 17, Zajac as modified teaches the invention as discussed above. However, it does not teach the collected input data further includes raw seismic sensor data, and using the raw seismic sensor data to produce quality indicators for the estimated positions, the quality indicators selected from binning datasets, absolute noise data, signal-to-noise ratios, and seismic signal frequency content.

60. Riley teaches the collected input data further includes raw seismic sensor data, and using the raw seismic sensor data to produce quality indicators for the estimated positions (Col 5, lines 61-66), the quality indicators selected from binning datasets, absolute noise data, signal-to-noise ratios, and seismic signal frequency content (Col 6, lines 3-67; Col 7, lines 1-15). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the quality indicators of Riley since such a modification would have provided data for error estimates in the processing of the data.

61. With respect to claim 23, Zajac as modified teaches a seismic survey spread having a plurality of spread control elements (Col 4, lines 51-54; Col 6, lines 34-57), a plurality of navigation nodes (Col 7, lines 22-25; Col 9, lines 4-12), and a plurality of seismic sources (Col 6, lines 40-42) and seismic streamers (Col 4, lines 51-52) containing receivers (hydrophones) (Col 1, lines 34-35), a database for receiving input

data (Col 4, lines 63-64; Col 8, lines 29-31); and a streamer control element (Col 8, lines 65-66). However, it does not have computer readable instructions for performing the method as taught in claim 1; and a seismic source control element.

62. Bennett teaches a seismic source control element (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Bennett with the source control element of Bennett since such a modification would have improved source control and lead to more accurate positioning and better coverage.

63. Riley teaches a computer readable medium having computer executable instructions (Col 13, lines 42-67; Col 14, lines 1-12). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the computer readable medium of Riley since such a modification would have allowed the method to be portable and executable on multiple systems.

64. Claim 20 is rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Bennett and further in view of Gikas et al, “Reliability analysis in dynamic systems: Implications for positioning marine seismic networks”, *Geophysics*, Vol. 64, No. 4, July-August 1999, pgs. 1014-1022.

65. Zajac as modified teaches the invention as discussed above. However, it does not teach the spread model is a pure stochastic model of the spread components (pg 1018, Col 1, lines 6-28).

66. Gikas teaches the spread model is a pure stochastic model of the spread components (pg 1018, Col 1, lines 6-28). It would have been obvious to one of ordinary skill

skill in the art at the time of the invention to modify the method of Zajac with the stochastic spread model of Gikas since such a modification would have given easily understandable measures of both internal and external reliability and can be used in both the design of seismic spread and in real time to ensure that appropriate quality control is possible.

67. Claim 21 is rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Armstrong et al., "The best parameter subset using the Chebychev curve fitting criterion", *Mathematical Programming,* Vol. 27, No. 1, September 1983, pages 64-74.

68. Zajac as modified teaches the invention as discussed above. However, it does not teach the spread model employs one of the L-norm fitting criteria.

69. Armstrong teaches that the L-norm fitting criterion is a widely studied curve fitting method (Abstract). Since Zajac gives a set of points for the positions of current and legacy data for the optimum spread component positions (Col 8, lines 1-15), it would have been obvious to one of ordinary skill in the art at the time of the invention to modify method of Zajac to use the L-norm fitting criteria of Armstrong to calculate the spread model by fitting the curve to the given points.

70. Claim 26 is rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Rau (6292436).

71. Zajac as modified teaches the invention as discussed above. However, it does not teach at least one of the controllers uses a PID correction method.

72. Rau teaches the invention as discussed above. However, it does not teach at least one of the controllers uses a PID correction method (Col 30, lines 63-66). It would

have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the PID algorithm of Rau since such a modification would have given a good positioning device command algorithm.

73. Claim 31 is rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Semb (6681710).

74. Zajac as modified teaches the invention as discussed above. However, it does not teach the drive commands include commands for controlling at least one vessel propeller, vessel thruster, vessel thruster setting, vessel propeller pitch, vessel propeller rotation speed, vessel rudder angle or combinations thereof.

75. Semb teaches the drive commands include commands for controlling at least one vessel propeller, vessel thruster, vessel thruster setting, vessel propeller pitch, vessel propeller rotation speed, vessel rudder angle or combinations thereof (Col 3, lines 34-36). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the vessel commands of Semb since such a modification would have allowed for more accurate positioning of the survey.

76. Claims 32-37 and 61 are rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Onat (6088298).

77. With regards to claim 32, Zajac teaches towing a plurality of seismic survey sources (Col 6, lines 40-42) and seismic streamers (Col 4, lines 51-52) containing receivers (hydrophones) (Col 1, lines 34-35) generally behind a vessel (Col 4, line 51) having one or more spread control elements (Col 4, lines 52-54). However, it does not teach estimating one or more positions of the sources based on data received from one

or more reference points on a seismic survey spread with respect to the earth; and activating only a selected portion of the sources that are at the proximities of the desired cross line positions.

78. Bennett teaches estimating one or more positions of the sources based on data received from one or more reference points on a seismic survey spread with respect to the earth (Col 6, lines 4-11; Col 9, lines 30-32). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Zajac with the source positioning of Bennett since such a modification would have improved the position data and control flexibility.

79. Onat teaches activating only a selected portion of the sources that are at the proximities of the desired cross line positions (Col 2, lines 55-56, 61-63).

80. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the source activation of Onat since such a modification would have allowed for the modification of the operational center frequency of the transducer array without excessive movement of the array.

81. With regards to claims 33-36, Zajac as modified teaches the invention as discussed above. Furthermore, it teaches seismic streamers containing receivers (hydrophones) (Col 1, lines 34-35) in a linear array (Fig 1); collecting input data from a seismic survey spread having a plurality of spread control elements (Col 4, lines 52-54), a plurality of navigation nodes (Col 2, lines 5-59; Col 7, lines 22-25; Col 9, lines 4-12), and a plurality of sources (Col 6, lines 40-42) and seismic streamers (Col 4, lines 51-52) containing receivers (hydrophones) (Col 1, lines 34-35); estimating positions of the

sources and receivers using the navigation data, the operating states, and the environmental data (Col 5, lines 5-7; Col 8, lines 29-31); determining optimum tracks for the sources and receivers using the estimated positions and a portion of the input data that includes at least the survey design data (Col 5, line 7, Col 8, lines 7-9); and calculating drive commands for at least two of the spread control elements using the determined optimum tracks (Col 5, lines 8-10); and the at least one of the spread control elements is a spread control element for a vessel or a spread control element for a receiver (Col 4, lines 52-54). However, it does not teach the number of the selected portion of the sources is less than the total number of sources; the selected portion of the sources form at least one linear source array parallel to the streamers.

82. Onat teaches the number of the selected portion of the sources is less than the total number of sources (Col 2, lines 55-56, 61-63; Fig 1); the selected portion of the sources form at least one linear source array parallel to the streamers (Col 2, lines 55-56, 61-63; Fig 1).

83. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the source activation of Onat since such a modification would have allowed for the modification of the operational center frequency of the transducer array without excessive movement of the array.

84. With regards to claim 37, Zajac teaches a vessel (Col 4, line 51) a plurality of seismic survey sources (Col 6, lines 40-42) and seismic streamers (Col 4, lines 51-52) containing receivers (hydrophones) (Col 1, lines 34-35) generally towed behind the vessel (Col 4, line 51) and having one or more spread control elements (Col 4, lines 52-

54); a controller coupled to the seismic survey sources, receivers and the spread control elements (Col 4, lines 56-58). However, it does not teach the controller is configured to estimate one or more positions of the sources; and activating only a selected portion of the sources that are at the proximities of the desired cross line positions; and a controller that activates the sources.

85. Bennett teaches the controller is configured to estimate one or more positions of the sources based on data received from one or more reference points on a seismic survey spread with respect to the earth (Col 6, lines 4-11; Col 9, lines 30-32). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Zajac with the source positioning of Bennett since such a modification would have improved the position data and control flexibility.

86. Onat teaches activating only a selected portion of the sources that are at the proximities of the desired cross line positions (Col 2, lines 55-56, 61-63); and a controller that activates the sources (Col 2, line 55).

87. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the source activation of Onat since such a modification would have allowed for the modification of the operational center frequency of the transducer array without excessive movement of the array.

88. With regards to claim 61, Zajac teaches steering the selected portion within a cross line corridor to the vicinity near the desired cross line positions (Col 8, lines 1-38).

89. Claims 47, 62, and 64 are rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Bennett and further in view of Lambert (2005/0180263).

90. With respect to claim 47, Zajac teaches providing a seismic survey spread having one or more vessels (Col 4, line 51) and one or more spread control elements (Col 4, lines 52-54), wherein the spread control elements comprise one or more vessel control elements (Col 4, lines 38-39), and one or more streamer control elements (Col 4, lines 52-54). However, it does not teach one or more source control elements, estimating one or more positions of the spread components based on data received from one or more acoustic positioning receivers and one or more reference points on the seismic survey with respect to the earth; and controlling the seismic survey spread by coordinating the positioning of the vessel control elements and the source control elements.

91. Bennett teaches one or more source control elements (Col 10, lines 64-65); and coordinating the positioning of the vessel control elements and the source control elements based on the estimated positions (Col 4, lines 20-58; Fig 1; Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the source control elements of Bennett since such a modification would have maximized the safety of the vessels, seismic assets, and crew while also minimizing deviations from desired spatial configuration of the assets. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the control element coordination of Bennett since such a modification would have provided additional flexibility and control over the array.

92. Lambert teaches estimating one or more positions of the spread components based on data received from one or more acoustic positioning receivers ([0007], lines 7-15) and one or more reference on the seismic survey with respect to earth ([0007], lines 3-7). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the acoustic positioning of Lambert since such a modification would have provided a relatively low cost and reliable way of determining positions of the spread components. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the earth reference points of Lambert since such a modification would have enabled more accurate repeat surveying.

93. With respect to claims 62 and 64, Zajac as modified teaches the invention as discussed above. However, it does not teach estimating one or more positions of the spread control elements based on data received from one or more acoustic positioning receivers and one or more reference points on the seismic survey spread with respect to the earth, wherein positioning of the streamer control elements and the source control elements are coordinated based on the estimated positions.

94. Lambert teaches estimating one or more positions of the spread components based on data received from one or more acoustic positioning receivers ([0007], lines 7-15) and one or more reference on the seismic survey with respect to earth ([0007], lines 3-7). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the acoustic positioning of Lambert since such a modification would have provided a relatively low cost and reliable way of

determining positions of the spread components. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the earth reference points of Lambert since such a modification would have enabled more accurate repeat surveying.

95. Bennett teaches coordinating the positioning of the vessel control elements, the source control elements, and the streamer control elements (Col 10, lines 60-65). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify they method of Zajac with the control element coordination of Bennett since such a modification would have provided additional flexibility and control over the array along the optimal path.

96. Claims 56-58 and 67 are rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Bennett and Onat and further in view of Lambert (2005/0180263).

97. Zajac as modified teaches the invention as discussed above. However, it does not teach teaches the reference points comprise at least two reference points wherein each reference point is located on opposite corners of the seismic spread; wherein each reference points is located at a corner of the seismic survey spread; estimating positions of the sources comprises estimating positions of the acoustic positioning receivers on the sources; and estimating the positions of the sources based on data received from one or more acoustic positioning devices.

98. Lambert teaches the reference points comprise at least two reference points wherein each reference point is located on opposite corners of the seismic spread ([0023]); wherein each reference points is located at a corner of the seismic survey

spread ([0023]); and estimating positions of the sources comprises estimating positions of the acoustic positioning receivers on the sources ([0002], lines 19-23); and estimating the positions of the sources based on data received from one or more acoustic positioning devices ([0002], lines 19-23). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Zajac with the reference points of Lambert since such a modification would have provided accurate earth based position coverage at both the front and rear positions of the spread. It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the method of Zajac with the acoustic positioning of Lambert since such a modification would have provided a relatively low cost and reliable way of determining positions of the spread components.

99. Claim 60 is rejected under 35 U.S.C. 103(a) as being obvious over Zajac in view of Bennett and further in view of Petersen (7047989).

100. Zajac as modified teaches the invention as discussed above. However, it does not teach a winch system relative to one or more outer streamer tow ropes.

101. Petersen teaches a winch system relative to one or more outer streamer tow ropes (Col 3, lines 11-13). It would have been obvious to one of ordinary skill in the art at the time of the invention to modify the system of Zajac with the winches of Petersen since the winches are already present in most surveys to deployment and retrieval of the cables, and using available equipment would reduce the cost of the survey.

Conclusion

The prior art which is cited but not relied upon is considered pertinent to applicant's disclosure.

The references made herein are done so for the convenience of the applicant. They are in no way intended to be limiting. The prior art should be considered in its entirety.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to KRYSTINE BREIER whose telephone number is (571)270-7614. The examiner can normally be reached on Monday thru Thursday, 8am-5:30pm EST and alternate Fridays 8am-4:30pm EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jack Keith can be reached on 571-272-6878. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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